MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2017/2018

EME4066 –OPERATIONS RESEARCH

(ME)

17 MARCH 2018
2.30 p.m. – 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 6 pages with 4 Questions only .
2. Attempt **ALL** questions . All questions carry equal marks and the distribution of the marks for each question is given .
3. Please write all your answers in the Answer Booklet provided .

QUESTION 1

(a) Pak Ali loves to eat steaks and potatoes. He realizes that this isn't the healthiest diet, so he decided to eat the right quantities of the two foods to satisfy some key nutritional requirement. Therefore he has decided to go on steady diet of only these two foods for all his meals. Table 1 contained the following nutritional and cost information:

Table 1

Ingredient	Grams of Ingredient per serving		Daily requirements (Grams)
	Steak	Potatoes	
Fat	20	4	≥ 60
Protein	25	10	≥ 50
Carbohydrates	5	11	≥ 55
Cost per serving (RM)	4	6	

Pak Ali wishes to determine the number of daily servings of steak and potatoes that will meet these requirements at a minimum cost.

(i) Formulate a linear programming model for this problem [6 marks]
(ii) Use graphical method to solve this model to obtain the optimal solution [8 marks]
(iii) How does the optimal solution change if the daily requirements for carbohydrates change to ≥ 70. [5 marks]

(b) Petronas Corporation is considering undertaking five projects over a 3 year planning horizon. The associated yearly expenditure and the expected returns for each project are summarized in Table 2.

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Table 2

Project	Expenditures (RM million)/year			Returns (RM million)
	1	2	3	
1	4	3	5	25
2	1	6	3	40
3	5	9	1	60
4	8	4	2	15
5	7	5	8	30
Available funds (RM million)	30	35	48	

Which projects should be selected over the 3 year horizon? Formulate a BIP model for this mathematical model. [6 marks]

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QUESTION 2

(a) Motorola manufacture Product A, B and C by using three different machines. Each unit of the product A, B and C has the available machine hour listed in Table 3. The contribution profit of these three products is RM 36 million, RM 42 million and RM 32 million.

Table 3

Machine	Product			Available hours
	A	B	C	
1	3	4	2	120
2	2	1	2	54
3	1	3	2	105
Profit (RM million)	36	42	32	

(i) Formulate the problem as a linear programming problem [5 marks]
(ii) Obtain the optimal solution to the problem by using the simplex method [13 marks]
(iii) What are the shadow prices of the machine hours? [2 marks]

(b) Write a dual linear programming for the below formulation. [5 marks]

$$Min\ z = 4x_1 + 5x_2 + 6x_3$$

Subject to

$$2x_1 + 3x_2 + 5x_3 \geq 20$$

$$3x_1 + x_2 + 7x_3 \leq 30$$

$$x_1 + 4x_2 + 6x_3 \leq 50$$

$$x_1, x_2, x_3 \geq 0$$

Continued ...

QUESTION 3

Nirvana Transport company ships truckloads of grain from three different cities- Perak, Alor Setar and Jitra to three mills located in Perlis, Terengganu and Penang. The supply and the demand (in ton) together with the unit transportation costs per truckload on the different routes are summarize in Table 4. The unit of transportation costs are in RM. The model seeks minimum cost shipping schedule between the cities and the mills.

Table 4

Cities	Mill			Supply (tonnes)
	Perlis	Terengganu	Penang	
Perak	6	8	10	150
Alor Setar	7	11	11	175
Jitra	4	5	12	275
Demand (tonnes)	200	100	300	

(i) By using NorthWest corner method obtain the initial feasible solution [6 marks]
(ii) By using least-cost method obtain the initial feasible solution [6 marks]
(iii) Obtain the optimal solution by using the stepping-stone solution method. Use the solution from Least cost method. [13 marks]

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QUESTION 4

(a) Secret Recipe planning to boost up their business, hence the management is planning to introduce new items of beverages. Depending on the future demand of the customer must serve, few alternative of beverages against nature of customers are being considered. The management team are well verse with the certainty the payoffs (in RM) will result under each alternative shown in Table 5.

Table 5: Expected payoff from action taken

Alternatives, S_i	Nature of customer, N_i		
	N_1	N_2	N_3
S_1	50	87	26
S_2	35	18	46
S_3	28	32	43
Prior Probability	0.1	0.4	0.5

The management has decided to use the following tools in making the decision. Which alternative is best, according to each of the following decision criteria?

i. Maximax Criterion [5 marks]
ii. Maximin Criterion [5 marks]
iii. Equal Likelihood Criterion [5 marks]

(b) Reduce the game shown in Table 6 by the dominance method and find the game value.

[10 marks]

Table 6: Payoff matrix

		Player B			
		1	2	3	4
Player A	I	3	2	4	0
	II	3	4	2	4
	III	4	2	4	0
	IV	0	4	0	8

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